

## CLAIMS:-

1. An electrophoresis gel plate for analysing or separating macromolecules in a mixture comprising a polymerised gel matrix supported by a hydrophilic microporous  
5 membrane.
2. The electrophoresis gel plate of claim 1, wherein the polymerised gel matrix comprises a cross-linked polyacrylamide gel.
- 10 3. The electrophoresis gel plate of claims 1 or 2, wherein the polymerised gel matrix comprises about 2.5 – 10.0% total acrylamide concentration.
4. The electrophoresis gel plate of claims 1 or 2, wherein the polymerised gel matrix comprises about 2.5-8% total acrylamide concentration.
- 15 5. The electrophoresis gel plate of claims 1 or 2, wherein the polymerised gel matrix comprises about 2.5-7% total acrylamide concentration.
6. The electrophoresis gel plate of claims 1 or 2, wherein the polymerised gel  
20 matrix comprises about 2.5-6% total acrylamide concentration.
7. The electrophoresis gel plate of claims 1 or 2, wherein the polymerised gel matrix comprises about 3-5% total acrylamide concentration.
- 25 8. The electrophoresis gel plate of claims 1 or 2, wherein the polymerised gel matrix comprises about 4% total acrylamide concentration.
9. The electrophoresis gel plate of any one of claims 1-8, wherein the polymerised gel matrix comprises a cross-linking agent.
- 30 10. The electrophoresis gel plate of claim 9, wherein the cross-linking agent is selected from the group consisting of bis-acrylamide, diacryl piperazine, DATD, N,N'-diallyl-tartardiamide or BAC, N,N'-bis(Acryloyl) cystamine or alternate cross-linking agent or mixture thereof.

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11. The electrophoresis gel plate according to claim 10, wherein the cross-linking agent is bis-acrylamide.
12. The electrophoresis gel plate of any one of claims 9-11, wherein the cross-link  
5 density is about 4-15%.
13. The electrophoresis gel plate of any one of claims 9-11, wherein the cross-link density is about 6-14%.
- 10 14. The electrophoresis gel plate of any one of claims 9-11, wherein the cross-link density is about 7-13%.
15. The electrophoresis gel plate of any one of claims 9-11, wherein the cross-link density is about 8-12%.
- 15 16. The electrophoresis gel plate of any one of claims 9-11, wherein the cross-link density is about 9-11%.
17. The electrophoresis gel plate of any one of claims 9-11, wherein the cross-link  
20 density is about 10%.
18. The electrophoresis gel plate of any one of claims 1-17, wherein the polymerised gel matrix is a hydrogel.
- 25 19. The electrophoresis gel plate of any one of claims 1-18, wherein the polymerised gel matrix is an isoelectric focussing gel matrix.
20. The electrophoresis gel plate of claim 19, wherein the polymerised gel matrix is selected from the group consisting of a fixed pH isoelectric gel matrix, carrier  
30 ampholyte isoelectric gel matrix and immobilised pH gradient gel matrix.
21. The electrophoresis gel plate of claim 20, wherein the polymerised gel matrix is a fixed pH isoelectric gel matrix.
- 35 22. The electrophoresis gel plate of claim 21, wherein the polymerised gel matrix comprises covalently attached buffers.

23. The electrophoresis gel plate of claim 21, wherein the polymerised gel matrix comprises acrylamido buffers co-polymerised with polyacrylamide.
- 5 24. The electrophoresis gel plate of any one of claims 19-23, wherein the isoelectric focussing gel matrix comprises a pH value of between 2 and 12.
25. The electrophoresis gel plate of claim 21, wherein the fixed pH isoelectric gel matrix comprises a pH value selected from the group consisting of 3, 3.5, 4, 4.5, 5, 5.5,  
10 6, 6.5, 7, 7.5, 8, 8.5, 9, 9.5, 10, 10.5, and 11.
26. The electrophoresis gel plate of any one of claims 19-25, wherein the polymerised gel matrix is suitable for use in a multi-compartment electrolyser apparatus.
- 15 27. The electrophoresis gel plate of any one of claims 1-18, wherein the polymerised gel matrix comprises an isoelectric gel matrix having an immobilised pH gradient.
- 20 28. The electrophoresis gel plate of claim 27, wherein the immobilised pH gradient is in the range of 2 to 12.
29. The electrophoresis gel plate of claim 27, wherein the immobilised pH gradient is selected from the group consisting of 2-10, 4-10, 5-9, 3-8, and 5-7.
- 25 30. The electrophoresis gel plate of any one of claims 1-18, wherein the gel matrix is a carrier ampholyte based isoelectric gel matrix.
31. The electrophoresis gel plate of claim 1, wherein the polymerised gel matrix  
30 comprises agarose.
32. The electrophoresis gel plate of claim 1, wherein the polymerised gel matrix comprises a hybrid agarose-polyacrylamide gel.
- 35 33. The electrophoresis gel plate of any one of claims 1-32, wherein the gel matrix is about 10% (v/v) thickness of the thickness of the microporous substrate.

34. The electrophoresis gel plate of any one of claims 1-32, wherein the gel matrix is between about 0.05mm and about 4mm thick.
- 5 35. The electrophoresis gel plate of any one of claims 1-32, wherein the gel matrix is between about 0.1mm and about 3mm thick.
36. The electrophoresis gel plate of any one of claims 1-32, wherein the gel matrix is between about 0.05mm and about 2mm thick.
- 10 37. The electrophoresis gel plate of any one of claims 1-32, wherein the gel matrix is between about 0.1mm and about 1mm thick.
38. The electrophoresis gel plate of any one of claims 1-32, wherein the gel matrix is between about 0.15mm and 0.5mm thick.
- 15 39. The electrophoresis gel plate of any one of claims 1-32, wherein the gel matrix is between about 0.01mm and about 0.5mm thick.
40. The electrophoresis gel plate of any one of claims 1-32, wherein the gel matrix is a monolayer.
- 20 41. The electrophoresis gel plate of any one of claims 1-40, wherein the hydrophilic microporous membrane is constructed of a polymeric material.
- 25 42. The electrophoresis gel plate of claim 41, wherein the polymeric material is a polyamide.
- 42.. The electrophoresis gel plate of claim 42, wherein the polyamide is nylon.
- 30 43. The electrophoresis gel plate of claim 41, wherein the microporous membrane is constructed of a cellulosic material.
44. The electrophoresis gel plate of claim 43, wherein cellulosic material is selected from the group consisting of cellulose, regenerated cellulose, cellulose acetate, or nitrocellulose or a mixture thereof.
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45. The electrophoresis gel plate of claim 41, wherein the microporous membrane is constructed of mixture of polymeric materials.
- 5 46. The electrophoresis gel plate of any one of claims 1-40, wherein the hydrophilic microporous membrane comprises a porous substrate, and an insoluble cross-linked hydrophilic material.
47. The electrophoresis gel plate of claim 46, wherein the insoluble cross-linked  
10 hydrophilic material coats the porous substrate.
48. The electrophoresis gel plate of claim 46, wherein the porous substrate is constructed of a porous polymer.
- 15 49. The electrophoresis gel plate of claim 48, wherein the porous polymer comprises a polymer selected from the group consisting of fluorinated polymers, polyolefins, polystyrene or substituted polystyrenes, polysulfones, polyesters, polyacrylates, polycarbonates, and vinyl polymers.
- 20 50. The electrophoresis gel plate of claim 48, wherein the porous polymer comprises a polymer selected from the group consisting of poly(tetrafluoroethylene), polyvinylidene fluoride (PVDF), polyethylene, ultra-high molecular weight polyethylene (UPE), polysulfone, polyethersulfone, polypropylene, polymethylpentene, polyethylene terephthalate, polybutylene terephthalate, polyvinyl chloride and  
25 polyacrylonitriles.
51. The electrophoresis gel plate of claim 48, wherein the porous polymer is a copolymer.
- 30 52. The electrophoresis gel plate of claim 51, wherein the copolymer comprises a material selected from the group consisting of butadiene and styrene, fluorinated ethylene-propylene copolymer, and ethylene-chlorotrifluoroethylene copolymer.
53. The electrophoresis gel plate of claim 46, wherein the insoluble, cross-linked  
35 material is one or more hydrophilic polymers.

54. The electrophoresis gel plate of claim 53, wherein the hydrophilic polymer is selected from the group consisting of hydroxy propyl acrylate, polyvinyl alcohol, polyethyl glycol, polyether sulfone, and regenerated cellulose or mixtures thereof.
- 5 55. The electrophoresis gel plate of claim 46, wherein the porous substrate has a pore size between about 0.65 micron and about 5.0micron.
56. The electrophoresis gel plate of claim 46, wherein the porous substrate is constructed of polyvinylidene fluoride and has a pore size selected from the group  
10 consisting of 0.65 micron, 1.2 micron, and 5.0 micron.
57. The electrophoresis gel plate of any one of claims 1-56, wherein the polymerised gel matrix fills the pores of the hydrophilic microporous membrane.
58. The electrophoresis gel plate of claim 57, wherein the polymerised gel matrix  
15 forms a continuous film.
59. The electrophoresis gel plate of any one of claims 1-58, wherein the electrophoresis gel plate is in a desiccated form.
- 20 60. The electrophoresis gel plate of any one of claims 1-58, wherein the electrophoresis gel plate is adapted for use in multicompartment electrolyser apparatus.
61. The electrophoresis gel plate according to claims 1-18, wherein the electrophoresis gel plate is an immobilised pH gradient gel.  
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62. A process of preparing an electrophoresis gel plate according to claim 1, comprising wetting a hydrophilic microporous substrate with a casting solution, and treating the casting solution to effect polymerisation to form a polymerised gel matrix supported by the hydrophilic microporous substrate.  
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63. The process of claim 62, wherein the process further comprises preparing a casting solution.
- 64 The process of claim 63, wherein the casting solution comprises acrylamide/bis  
35 monomers and acrylamido buffers.

65. The process of claim 62, wherein the hydrophilic microporous membrane and casting solution are subjected to a mechanical force to remove excess gel solution.
66. The process of claim 65, wherein the mechanical force comprises one or more  
5 rollers.
67. The process of claim 62, wherein the casting solution is treated to effect polymerisation.
- 10 68. The process of claim 67, wherein treating the casting solution comprises applying heat for a time and under sufficient conditions to effect polymerisation.
69. The process of claim 67, wherein treating the casting solution comprises applying a sufficient amount of UV light to achieve polymerisation.
- 15 70. The process of any one of claims 62-69, wherein the process further comprises recovering the gel plate comprising the polymerised gel matrix supported by the hydrophilic microporous substrate.
- 20 71. The process of any one of claims 62-70, wherein the process further comprises washing and/or drying the gel plate.
72. Use of an electrophoresis gel plate in the separation or analysis of at least one macromolecule in a mixture, wherein the electrophoresis gel plate comprises a  
25 polymerised gel matrix supported by a hydrophilic microporous substrate.
73. The use according to claim 72, wherein the electrophoresis gel plate is adapted for a multicompartement electrolyser.
- 30 74. A method of analysing or separating macromolecules in a mixture comprising:  
(i) placing the mixture of macromolecules in a separator apparatus comprising at least one electrophoresis gel plate, and  
(ii) performing electrophoresis on the mixture  
wherein the electrophoresis gel plate comprises a polymerised gel matrix supported by  
35 a hydrophilic microporous membrane.

75. The method of claim 74, wherein the electrophoresis gel plate comprises an electrophoresis gel plate according to any one of claims 1-61.
76. The method of claim 74, wherein the separator apparatus comprises electrodes  
5 for applying an electric field.
77. The method of claim 74, wherein the separation apparatus is a multicompartment electrolyser.
- 10 78. The method of claim 77, wherein the multicompartment electrolyser comprises two or more electrophoresis gel plates.
79. The method of claim 78, wherein the two or more electrophoresis gel plates have different pI values.
- 15 80. A kit for analysing or separating macromolecules in a mixture, the kit comprising one or more electrophoresis gel plates according to claims 1-61, buffers and optionally instructions for use.
- 20 81. The kit of claim 80, wherein the kit further comprises any one or more of the following:  
urea, thiourea, CHAPS, carrier ampholytes or in a multicompartment electrolyser apparatus.
- 25 82. The kit of claims 80 and 81, wherein the kit comprises two or more electrophoresis gel plates.
83. The kit of claim 82, wherein the two or more electrophoresis gel plates have two or more different pH values.